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Transportation Study Update

ATTACHMENT 5

Longwood Medical Area

Boston,
Massachusetts

Prepared for **Medical Area Service Corporation**
Boston, Massachusetts

Prepared by **Vanasse Hangen Brustlin, Inc.**
Watertown, Massachusetts

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February 1992

LONGWOOD MEDICAL AREA TRANSPORTATION STUDY UPDATE

LONGWOOD MEDICAL AREA
Boston, Massachusetts

Prepared for: Medical Area Service Corporation

Prepared by:

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INTRODUCTION

Transportation in Boston's Longwood Medical Area (LMA) is of critical concern because of the many people who are affected by it, including area residents, employees of LMA institutions and businesses, and commuters who traverse LMA streets en route to and from work in other areas of the city. Recognizing the importance of maintaining high quality transportation services and traffic flow along city streets, the Medical Area Service Corporation (MASCO) has undertaken numerous studies of transportation conditions in the LMA.

The most recent comprehensive study of transportation conditions was the 1987 LMA Transportation Study[1] that examined traffic, parking and transit issues in this important section of the city. This document represents an update of this study.

This LMA Transportation Study update has been prepared in the context of an areawide planning and rezoning process currently being undertaken by the Boston Redevelopment Authority. The goal of this element of the study is to update, reevaluate, and revise, as necessary, the findings and recommendations of the 1987 study to provide a framework for transportation planning and policy development for the LMA by MASCO, its members, and the city. The time frame extends from existing conditions through the 1990s.

Organization of Report

This report is organized into several sections presenting:

- A summary of key findings
- A description of area development patterns (1987 to 1991) and forecasts (1992 to 1999) in order to establish relationships between land use and parking and between land use and traffic generation
- A description of employee, patient/visitor, and student travel patterns as contributors to parking and traffic demands
- A summary of traffic characteristics on LMA streets and key intersections comparing 1987 conditions with existing 1991 conditions
- An historical (1960 to 1990) evaluation of parking supply within and serving the LMA, including the relationship between parking and building development
- Vehicle trip generation estimates associated with future development forecasts, and
- A discussion of areawide transportation mitigation measures, including strategies being undertaken and policies being pursued by MASCO and others

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1/ Longwood Medical Area Transportation Study, prepared as three technical memoranda for the Medical Area Service Corporation (MASCO), by Vanasse Hangen Brustlin, Inc., 1987-1988.

Planning Context

The Longwood Medical Area (LMA) is a 175-acre site located adjacent to the Fenway and Mission Hill neighborhoods of Boston (see Figure 1). Its high concentration of institutions has grown over an eighty-year period to be one of the most prestigious centers of medical and educational service in the region and the country. The Medical Area Service Corporation (MASCO) is a shared service organization in the Longwood Medical Area. Created in 1972 by medical and educational institutions, MASCO assists its members as well as other non-profit institutions in carrying out their functions effectively and efficiently. MASCO's goals are: to reduce costs by creating economies of scale; to provide support services for LMA employees and students; and to create a sense of community through area-wide planning and development efforts.

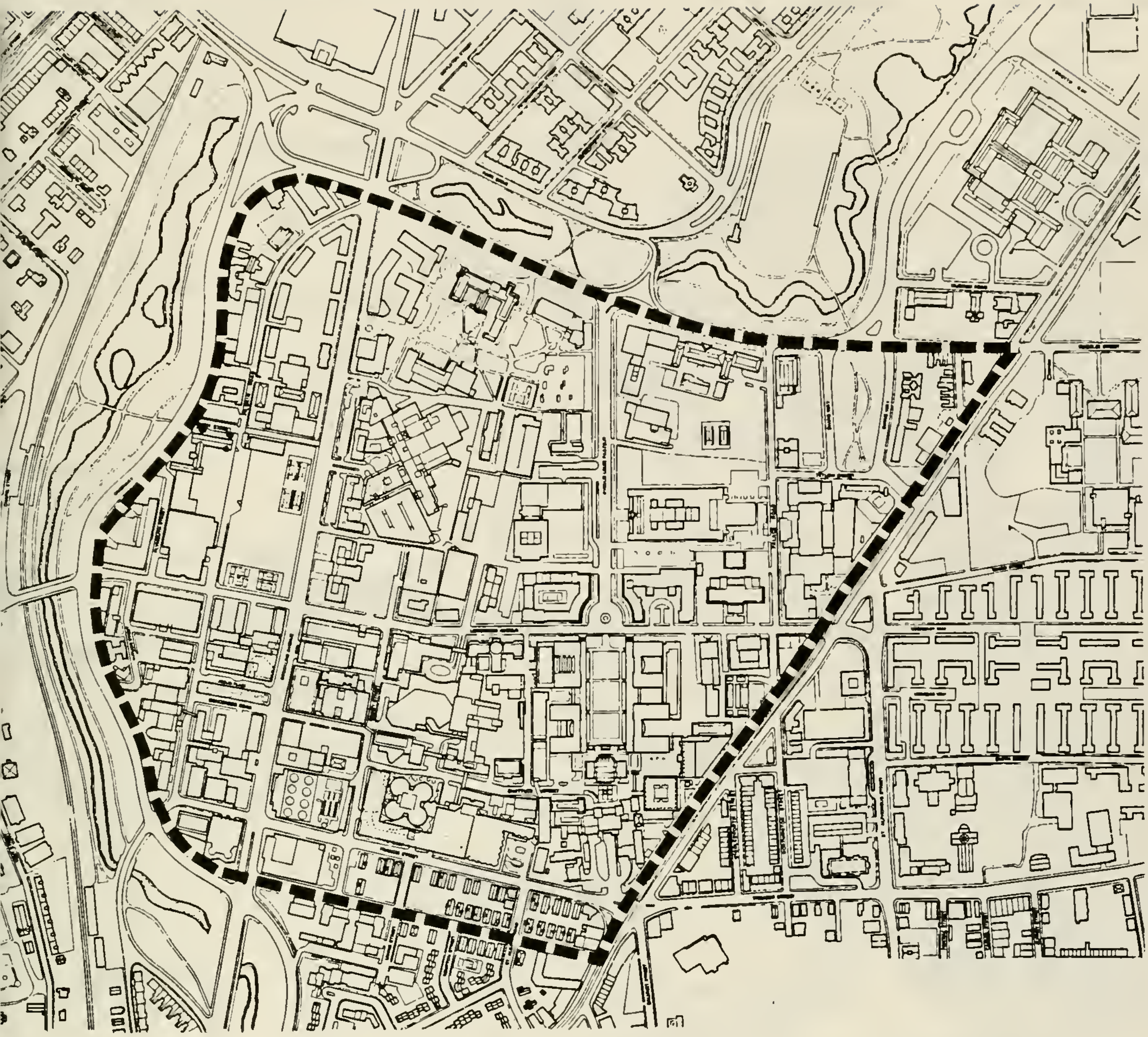
MASCO's 15 member institutions include four major teaching hospitals (Beth Israel, Brigham & Women's, Children's, and New England Deaconess), two important research treatment centers (Dana-Farber Cancer Institute and Joslin Diabetes Center), the Harvard Medical School, Harvard School of Dental Medicine, and Harvard School of Public Health, four other historic colleges (Emmanuel, Simmons, Wheelock, and Massachusetts College of Pharmacy and Allied Health Sciences), a girls' preparatory school (The Winsor School), and Temple Israel. Non-member institutions located in the LMA include the state-owned Massachusetts College of Art and Massachusetts Mental Health Center, Boston Latin High School, and the private non-profit Judge Baker Children's Center.

In total, these 19 institutions coexist with other land uses in an intensely urbanized area bounded by The Riverway, Fenway, Francis Street/Fenwood Road, and Huntington Avenue. Adjacent to the LMA are the Town of Brookline and two Boston neighborhoods: the Fenway and Mission Hill. Also located nearby are other important Boston institutions, including the Museum of Fine Arts, Boston University, Wentworth Institute of Technology, and Northeastern University, to name a few. Downtown Boston lies just two miles to the northeast.

The LMA is traversed by several commuting routes to downtown Boston. Figure 2 identifies the major regional transit services that serve both the LMA and downtown Boston. The combination of LMA land uses, its proximity to surrounding areas, the location of off-site parking facilities in the vicinity of the LMA, and its location along major downtown commuting routes presents challenging transportation problems. Adding to this challenge is the need for additional development among the member institutions in order to accommodate their program needs.

Overview of Transportation Improvements (1987-1991)

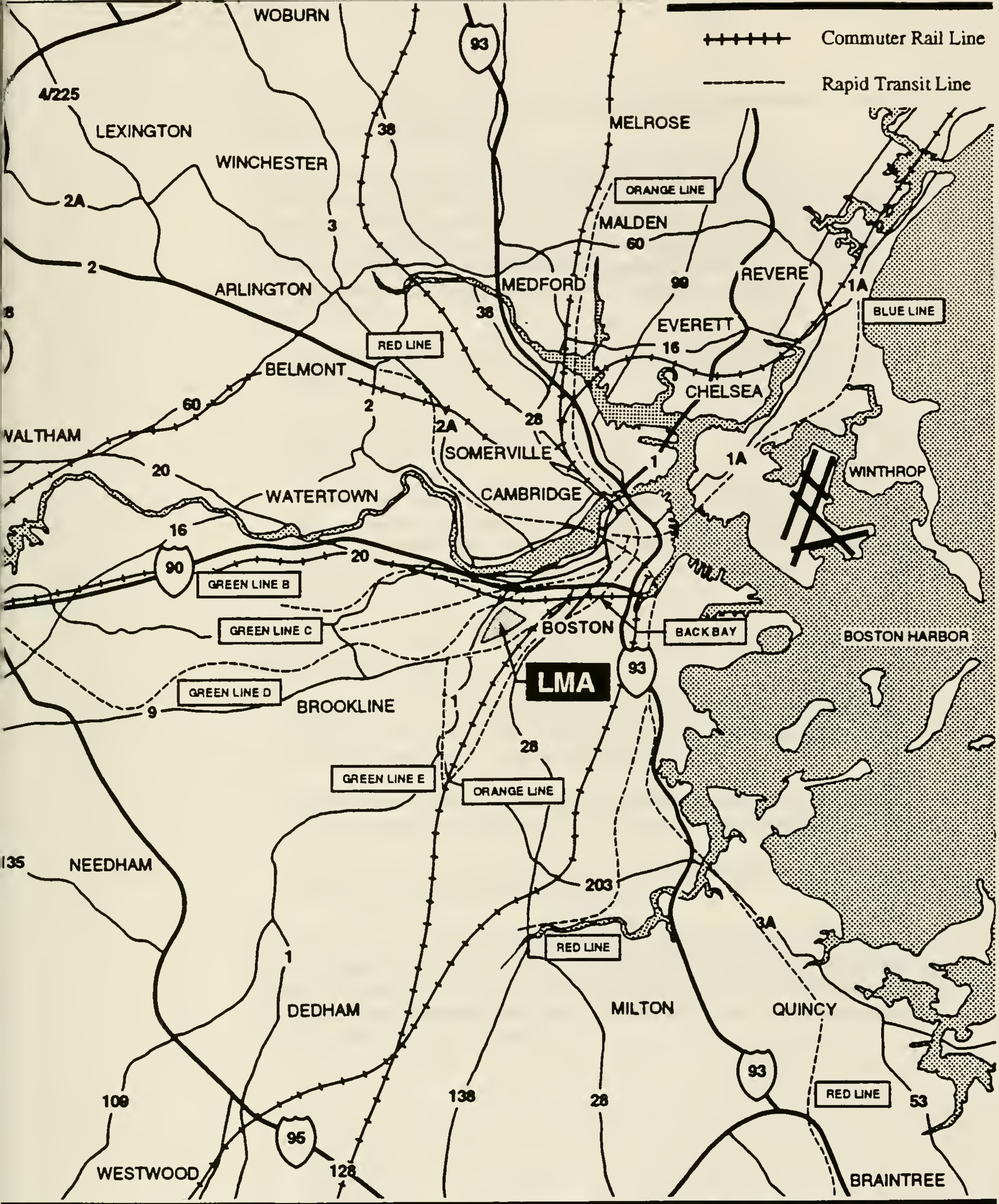
The 1987 LMA Transportation Study comprehensively evaluated existing transportation conditions in the LMA. The three reports developed from the study included information on traffic flows, employee and commuter travel patterns, parking, transit, and the pedestrian environment. The study included a five-year projection of area growth and development as well as an assessment of future transportation conditions likely to exist in 1992 related to LMA growth and background development. The highlight of this study was the extensive set of recommendations developed including measures to improve traffic flow,



Vanasse Hangen Brustlin, Inc.

Study Area Map

Figure 1



Vanasse Hangen Brustlin, Inc.

Existing Regional Transit Services Figure 2

reduce vehicle trips, increase use of transit, better manage parking, and enhance the pedestrian environment.

Since completion of the study, some significant accomplishments and improvements have been made and other important changes have occurred. Among the accomplishments are the completion of a computerized traffic model of the LMA transportation network and the receipt of Federal funding to establish a transportation management organization (TMO), known as CommuteWorks. The improvements, outlined in the mitigation section of this report, include:

- Implementation or expansion of transit pass subsidy programs at most member institutions

- Completion of an initial phase of roadway capacity improvement projects on Brookline and Longwood Avenues, and

- Various other improvement strategies such as transit service enhancements, upgrades of construction management programs, traffic control improvements, and increased landscaping to improve the pedestrian environment. These are further described in the mitigation section of this report.

Other changes since 1987, outlined in the development patterns and traffic patterns sections include:

- Revisions to the mix and size of certain LMA development projects anticipated to occur by 1992, resulting in less square feet of development but a slight increase in future traffic forecasts

- A significant reduction in daily and peak hour traffic volumes on several arterial streets such as Brookline Avenue and The Riverway, and

- The economic downturn in the Boston region, which has resulted in fewer commuters traveling on LMA roadways.

These changes in both development and in observed traffic volumes have eased certain congestion problems in the LMA. Other deficiencies remain, however, and as discussed below, it is the goal of MASCO and its members to implement both capacity enhancement and demand reduction improvements to further alleviate congestion on LMA streets.

SUMMARY OF KEY FINDINGS

This LMA Transportation Study update has been prepared in the context of an areawide planning and rezoning process currently being undertaken by the Boston Redevelopment Authority. The time frame extends from existing conditions through the 1990s. The major findings of this study follow:

- The 1987 LMA Transportation Study, which comprehensively evaluated existing transportation conditions in the LMA, included a five-year projection of area growth and development as well as an assessment of future transportation conditions likely to exist in 1992 related to LMA growth and background development. The 1987 study had forecast that 741,000 square feet (SF) of development would occur within the LMA by 1992. This forecast has been revised downward slightly to approximately 720,000 SF but with a different mix of land uses, including more outpatient and office development and less research space. The forecast addition of parking spaces has also been revised to an increase of 1,100 spaces from an earlier forecast of a 1,787 space increase.

- The travel patterns of employees commuting to the LMA have remained relatively unchanged over the past decade with approximately 56 to 57 percent of workers traveling by automobile. The fact that the percentage of employees traveling by automobile has not changed significantly over the past ten years is extremely encouraging. During this time period, the LMA has grown significantly (by 1.4 million square feet) and the number of employees has also grown. It is likely that limited parking, price disincentives, and the expansion of alternative modes of transportation have contributed to limiting increased automobile usage.

- One of the most noticeable changes that have occurred in the LMA is related to vehicular traffic on the street system. Between 1987 and 1991, traffic volumes on streets such as The Riverway and Brookline Avenue have declined on a daily basis (between 14 and 22 percent) as well as during the peak commuting hours. A major contributing factor to the change in traffic is the downturn in the regional economy. Since fewer workers are traveling to and from Downtown Boston, traffic on primary commuting routes such as Brookline Avenue and The Riverway has also declined. In fact, when the change in daily traffic volumes on Brookline Avenue, Huntington Avenue, and The Riverway are combined, the total daily traffic on the north-south arterials has declined by just under 9 percent.

  Traffic volumes on Huntington Avenue and Longwood Avenue are up on a daily basis. On Huntington Avenue, this change can be attributed to the completion of roadway reconstruction efforts that were underway when the 1987 counts were taken. The changes on Longwood Avenue may be a result of recent improvements to the intersection of Longwood and Brookline Avenues and an increase in development along this roadway.

- An evaluation of intersection level of service (LOS) was conducted to compare peak hour traffic conditions in 1987 with those in 1991 for seven of the LMA intersections. In general, the analysis showed that the number of deficient intersections within the LMA has declined. The analysis also showed that during the morning peak hour, the LOS has improved at two intersections, remained the same at two intersections and declined at three intersections. During the evening peak hour, the LOS improved at three

intersections, remained the same at three intersections and declined at one intersection.

- Between 1993 and 1999, it is estimated that LMA institutions have plans to construct up to 2.2 million SF of space and 1,273 additional parking spaces. The mix of land uses proposed in the future is relatively evenly spread between research, inpatient, outpatient, and other uses. This future development is projected to result in up to 1,500 additional peak hour vehicle trips.

- An historical trend analysis was conducted comparing the parking supply and building area of the major medical institutions and the Harvard schools in the LMA. The data showed that despite a dramatic increase in the rate of car ownership and the shift toward more outpatient activities, the ratio of parking supply to building area has remained relatively constant over the past 30 years, ranging between 0.93 spaces per thousand SF to 1.11 spaces per thousand SF. This trend is projected to continue through the end of this decade.

- A number of the mitigation measures recommended in the 1987 study have been implemented and many of the others are still valid. The major measures recommended for consideration over the next few years include roadway construction strategies on Avenue Louis Pasteur, The Fenway, and The Riverway, evaluation of traffic signal operations throughout the LMA including improvements to traffic signals along Brookline Avenue, improvements to the MASCO shuttle and its connections to the LMA from off site facilities and major MBTA stations, increased enforcement of parking and traffic regulations, and pedestrian access improvements.

DEVELOPMENT CHARACTERISTICS

One of the components of the 1987 study was a forecast of institutional development over the next five years. Since this study is being prepared in the latter part of 1991, a revised forecast of development changes since 1987 up to 1992 has been prepared. In addition, as part of this study, forecasts for development between 1993 and 1999 have also been prepared. This information has been compiled by MASCO based on input of member institutions. Table 1 summarizes this information according to the size and composition of land uses proposed, the total development forecast, and the projected parking supply to serve the new development.[2]

As shown, because of changes made by individual institutions and delays in projects still being planned, the 1987 to 1992 forecast has been revised from 741,000 net new square feet (NNSF) and 1,787 parking spaces to 719,679 NNSF and 1,100 spaces. For the period from 1993 to 1999, the forecast is for an additional 2,122,322 NNSF and an additional 1,273 parking spaces.[3] In addition to the changes in development size, the composition of the development has also changed. This is illustrated further in Figure 3. As shown, the initial forecast for development consisted of approximately 66 percent research uses, 12 percent office uses, 8 percent outpatient uses, 2 percent inpatient uses, and 12 percent other uses such as retail, hotel, and child care. The revised forecast reduced the research uses to 58 percent, increased the office uses to 17 percent, increased outpatient uses to 14 percent, reduced inpatient uses to zero, and reduced other uses to 11 percent. For the 1993 to 1999 period, the mix has been projected to be 27 percent research uses, 28 percent inpatient uses, 23 percent outpatient uses, and 22 percent other uses.

Table 1

COMPARISON OF DEVELOPMENT AND PARKING SUPPLY FORECASTS

	Percent Distribution By Land Use Category			
Land Use	Initial Forecast 1987-1992	Revised Forecast 1987-1992	Projected 1993-1999	Total* 1987-1999
Research	66%	58%	27%	35%
Inpatient	2%	0%	28%	21%
Outpatient	8%	14%	23%	21%
Office	12%	16%	3%	7%
Other	0%	0%	19%	16%
Total	100%	100%	100%	100%
Net New Square Feet	741,000	719,679	2,211,361	2,931,040
Parking Spaces	1,787	1,100	1,273	2,373

* Total includes revised 1987-1992 forecast plus 1993-1999 forecast.
Source: MASCO Area Planning and Development Department

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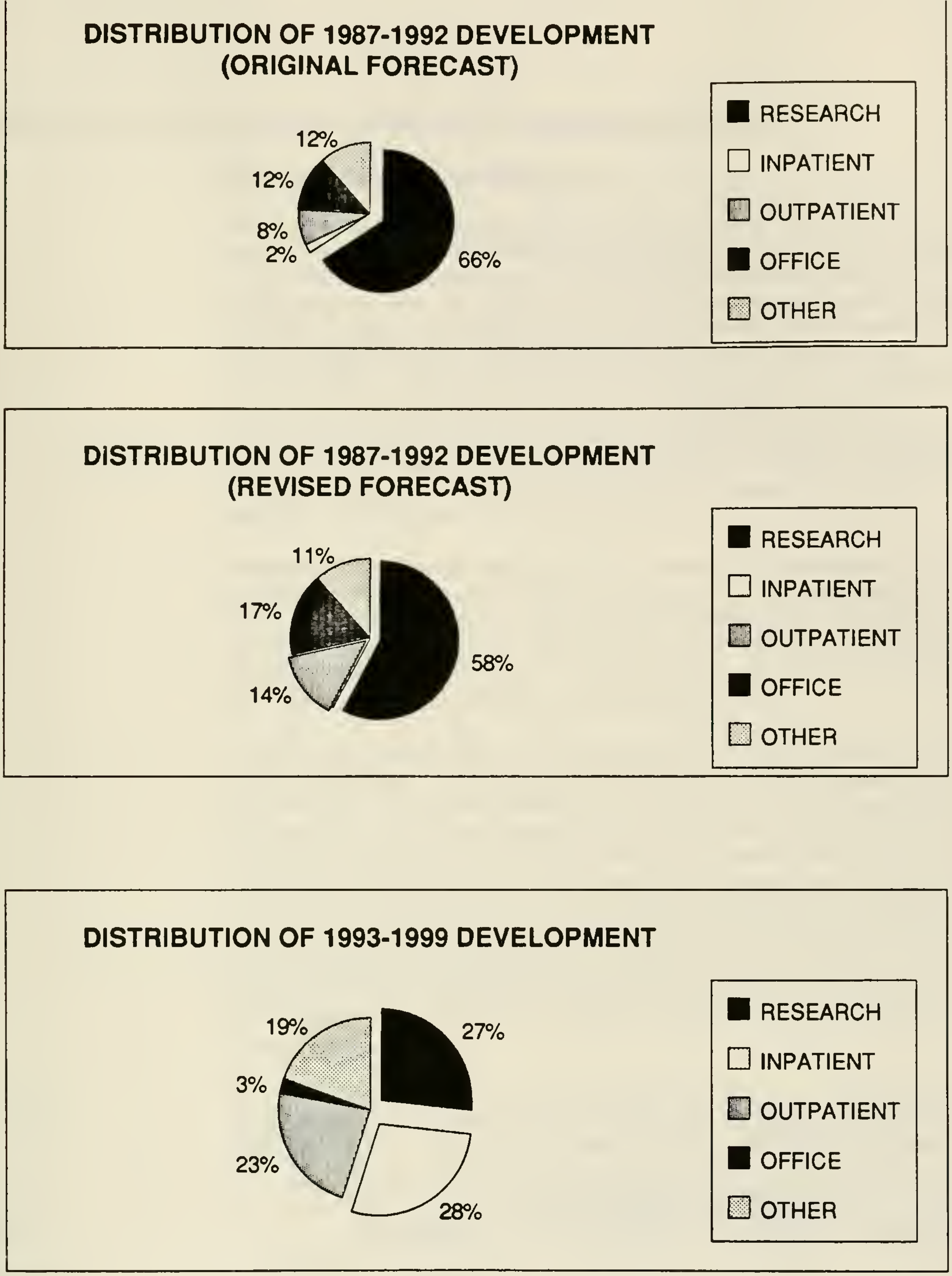
[2] The forecasts includes projects within the study area defined in Figure 1. The proposed Olmsted Plaza development is not included.

[3] These projections are subject to change and are potentially optimistic given the time frame for project development and recent trends.



Distribution of LMA Development
by Land Use (1987-1999)

Figure 3

EMPLOYEE, PATIENT/VISITOR, AND STUDENT TRAVEL PATTERNS

Previous Transportation Surveys

When the LMA Transportation Study was prepared in 1987, there was a limited amount of information available regarding the travel patterns of employees working in the LMA and almost no information on patients and visitors traveling to the area. The primary resource for data regarding work-trips by employees was the 1980 census. Since then, several of the LMA institutions have completed detailed transportation master plans for the Boston Redevelopment Authority and the Boston Transportation Department. These master plans have included surveys of the travel patterns of employees, patients, visitors, and students. Table 2 compares the results of these surveys with the 1980 census data. As shown, based upon a weighted average of the employee surveys, the overall employee commuting patterns remained approximately the same throughout the 1980s.

The fact that the percentage of employees traveling by automobile has not changed significantly over the past ten years is extremely encouraging. During this time period, the LMA has grown significantly (by 1.4 million square feet) and the number of employees has also grown. It is likely that limited parking, price disincentives, and the expansion of alternative modes of transportation have contributed to limiting increased automobile usage.

It should be noted that the surveys summarized in Table 2 were completed either just before or at the inception of several institution's transit pass subsidy programs and before the formalization of CommuteWorks. Since 1987-88 when the T pass subsidies either began to be offered or were increased in value at the four major hospitals, the number of monthly T passes sold increased from just under 1,700 passes per month to just under 5,300 passes per month in late 1991, an increase of over 215 percent. Areawide sales at all member institutions are over 6,000 passes per month. Based upon the increased volume of transit pass sales within the institutions offering subsidy programs, follow-up surveys could be expected to show an increased level of transit usage. In particular, transit usage by daytime employees may well now be greater than the weighted averages in the table.

Table 2

COMPARISON OF 1980 CENSUS JOURNEY-TO-WORK DATA WITH MASTER PLAN SURVEYS OF EMPLOYEE TRAVEL PATTERNS

	Percent of Employees Arriving By:			
Source	Survey Year	Drive/Ride	Transit	Walk/Bike
1980 Census	1980	56%	26%	18%
Weighted Average of Institutional Employees		57%	29%	14%

Source: Vanasse Hangen Brustlin, Inc.

Student, Patient and Visitor Travel Patterns

Data on student, patient, and visitors travel are not as plentiful as that for employees. Patient and visitor travel patterns derived from the limited surveys that have been undertaken at member institutions indicate that among the institutions surveyed, approximately 60 percent of patients and visitors travel by private automobile. In a study for the Harvard Medical Campus, it was found that approximately 34 percent of non-resident students travel to the Harvard Longwood campus by private automobile and park in the LMA. Others arrive by public transportation, walk, or bicycle. The travel patterns of students at other LMA institutions will be determined in future surveys by MASCO.

TRAFFIC CHARACTERISTICS OF AREA ROADWAYS

Traffic System Changes Since 1987-1988

Since the completion of the LMA Transportation Study, a number of changes have occurred in the LMA that have likely impacted both travel patterns within the LMA and peak period traffic volumes. These changes are as follows:

- Portions of the roadway surface along Brookline Avenue and Longwood Avenue were reconfigured to provide additional turn lanes and through travel lanes. The first phase of this plan, funded by MASCO out of its area planning improvement fund was implemented in August and September of 1990. Parking meters were removed along several segments of Brookline Avenue and all of Longwood Avenue. This project has improved flow along both streets and has reduced delays at the intersection of Brookline and Longwood Avenues.

- Huntington Avenue, under construction during 1987, is operating at a higher level of capacity as a result of the completion of the Massachusetts Department of Public Works reconstruction project in 1989.

- Additional parking facilities have been developed outside of the LMA increasing the off-site supply by approximately 320 spaces. The development of additional parking around the periphery of the LMA is believed to have been a small contributing factor to the reduction in vehicle trips on primary LMA streets.

- Both Beth Israel Hospital and Children's Hospital have instituted direct shuttle bus service from off-site parking facilities to the hospitals. This has increased the appeal of off-site parking to some employees who might otherwise try to park closer to the hospital despite the fact that few spaces are available.

- Changes to transit routes include the extension of MBTA bus route 8/8A to Kenmore Square, the extension of MBTA bus route 66 to Harvard Square, and the provision of MetroBus/Brigham & Women's Hospital shuttle service to 850 Boylston Street in Brookline. Ridership on MetroBus, MASCO's bus service, has remained relatively constant over the past few years at 3,000 daily riders on both the Cambridge route and parking shuttle routes.

Evaluation of 1987-1991 Traffic Volume Changes

As mentioned earlier, in addition to the changes that have occurred in roadway capacity and off-site parking, economic conditions have also changed since 1987. Fewer workers are travelling to and from Downtown Boston now than in 1987, apparently resulting in fewer through vehicle-trips overall on LMA arterials such as The Riverway, Brookline Avenue and Huntington Avenue.

The 1987 LMA Transportation Study included a comprehensive traffic data collection component comprised of automatic traffic recorder counts and manual intersection turning movement counts at numerous locations. As part of MASCO's efforts to monitor traffic conditions on LMA streets, and as part of transportation access planning for a number of area development projects, several LMA intersections and roadways segments have been counted since the 1987 study. Table 3 summarizes the results from roadway counts at eight locations taken in 1990 and 1991 and compares the traffic volumes with 1987 conditions.

Table 3

COMPARISON OF DAILY TRAFFIC VOLUMES (1986-1991)

	Daily 1986-87	Daily 1990-91	Change	
			Number	Percent
Longwood east of Plymouth	7,620	8,540	920	12%
Longwood east of Brookline	12,516	13,484	968	8%
Francis east of Brookline	13,340	10,745	-2,595	-19%
Riverway north of Longwood	25,526	21,891	-3,635	-14%
Huntington north of Longwood	26,440	29,611	3,171	12%
Brookline south of Longwood	28,276	22,025	-6,251	-22%
Brookline south of Pilgrim	28,659	24,657	-4,002	-14%
Riverway south of Brookline	38,030	30,450	-7,580	-20%

Source: Vanasse Hangen Brustlin, Inc. and MASCO

As shown in the table, daily traffic volumes along Longwood Avenue between Plymouth Street and Brookline Avenue increased by 12 percent. Increased volumes on Longwood Avenue may be due to the recent restriping of the roadway, as well as other changes in the area of Pilgrim Road. Vehicle traffic along Huntington Avenue also increased by 12 percent. This increase is potentially the result of a shift of motorists back to Huntington Avenue after its reconstruction was completed in 1989.

Daily traffic volume decreased on The Riverway, Brookline Avenue and Francis Street. Traffic volumes along The Riverway decreased by 14 percent north of Longwood Avenue and 20 percent south of Brookline Avenue. Brookline Avenue traffic volumes decreased 22 percent south of Longwood Avenue and 14 percent south of Pilgrim Road. Since both roadways are heavily used by commuters whose trips do not originate or terminate in the LMA,[4] some of the traffic decrease may be due to current economic conditions in the Boston region. Since fewer workers are traveling to and from Downtown Boston, traffic on primary commuting routes such as Brookline Avenue and The Riverway has also declined. In fact, when the change in daily traffic volumes on Brookline Avenue, Huntington Avenue, and The Riverway are combined, the total daily traffic on the north-south arterials has declined by just less than 9 percent.

Francis Street experienced a 19 percent decrease in daily traffic volume east of Brookline Avenue. This change is likely a combination of shifts to Huntington Avenue and shifts to avoid congestion at the Brookline Avenue/Francis Street intersection.

It should be noted that some of these counts were taken during the period when both the 750-space MASCO Mixed Use Development at 375 Longwood Avenue was under construction on the site of the former Temple Israel 225-space parking lot and the 500-space Harvard Longwood garage was under construction. The Harvard project has been completed and the MASCO Mixed Use Development is currently nearing completion (the parking garage is now open).

A reduction in traffic volumes is also apparent during the morning and evening peak hours of travel. As shown in Table 4, during both peak hours all street segments counted in 1990 but one (Huntington Avenue) carried fewer vehicles than in 1987. This finding is potentially significant because although through traffic has decreased, development projects at several area institutions have been completed, adding peak hour vehicle-trips to LMA streets. Accordingly, the net effect of these projects during peak periods has been reduced. Should through traffic return to earlier levels, then existing congestion levels would also increase.

4/ In the 1987 LMA Transportation Study, it was shown that 37 percent of morning peak period and 63 percent of evening peak period traffic on Brookline Avenue was through traffic. The Riverway's through traffic consisted of 84 percent of total traffic during both peak periods.

Table 4 COMPARISON OF MORNING AND EVENING PEAK HOUR TRAFFIC VOLUMES (1986-1991)

	Morning Peak Hour		Change		Evening Peak Hour		Change	
	1986-87	1990-91	Number	Percent	1986-87	1990-91	Number	Percent
Longwood Ave. east of Plymouth St.	625	607	-18	-3%	615	611	-4	-1%
Longwood Ave. east of Brookline Ave.	920	869	-51	-6%	980	873	-107	-11%
Francis St. east of Brookline Ave.	935	767	-168	-18%	665	688	23	3%
Riverway north of Longwood Ave.	1,635	1,344	-291	-18%	1,810	1,763	-47	-3%
Huntington Ave. north of Longwood Ave.	1,845	1,888	43	2%	1,920	2,072	152	8%
Brookline Ave. south of Longwood Ave.	1,565	1,311	-254	-16%	1,745	1,439	-306	-18%
Brookline Ave. south of Pilgrim Rd.	1,885	1,552	-333	-18%	1,940	1,501	-439	-23%
Riverway south of Brookline Ave.	2,505	2,091	-414	-17%	2,755	2,031	-724	-26%

Source: Vanasse Hangen Brustlin, Inc. and MASCO

Level-of-Service Analysis Update

In order to quantify the effects of traffic volume and other changes on intersection operations, a level-of-service (LOS) analysis was conducted at seven key intersections in the LMA. Levels of service for signalized intersections are calculated using the operational analysis methodology of the 1985 Highway Capacity Manual (HCM).[5] This method assesses the effects of signal type, timing, phasing, progression, vehicle mix, and geometrics on delay. Level-of-service designations are based solely on the criterion of average stopped delay per vehicle, since delay is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The overall level of service is designated by a letter grade which can range from A (free-flow) to F (congested).

This analysis was conducted to update the findings of the 1987 Transportation Study which evaluated 13 signalized intersections. Presented in Table 5 is a summary of the intersection level of service for the seven intersections studied in 1991 and a comparison with 1987 conditions.

5/ Highway Capacity Manual, Special Report 209; Transportation Research Board, Washington, DC (1985).

As shown in Table 5, based on the recent traffic volumes and field timings of traffic signal operations, during the morning peak hour, the LOS has improved at two intersections, remained the same at two intersections and declined at three intersections. During the evening peak hour, the LOS improved at three intersections, remained the same at three intersections and declined at one intersection. The table also shows that currently, during the morning peak hour, three intersections operate at LOS F while during the evening peak hour, two intersections operate at LOS E and two others operate at LOS F.

The changes in level of service can be attributed to many factors. In several cases, such as at the intersections of Longwood Avenue and The Riverway, Longwood Avenue and Huntington Avenue, and Huntington Avenue and Francis Street, the signals operate differently than in 1987. The travel lanes serving the intersection of Brookline Avenue and Longwood Avenue have been restriped to increase its capacity, and this is reflected in the LOS improvement. At several other locations, traffic volumes have changed significantly. Most of the traffic volume changes do not appear to be related to LMA employees commuting to or from work. For example, at the intersection of Longwood Avenue and The Riverway, during the morning peak hour northbound through movements and left turns, southbound right turns and eastbound left turns have all increased significantly. These increases, in combination with a modified signal operation, have resulted in a degradation from LOS D to LOS F. Consistent with the results of the traffic volume changes discussed above, the degradation of the LOS at the intersection of Longwood Avenue and Huntington Avenue in both peak hours (from LOS D to F) is partially a result of an increase in through traffic volume on Huntington Avenue. The signal timing does not reflect the changes in traffic volume and should be evaluated for possible readjustment, as described further in the mitigation discussion below.

The 1987 study conducted an analysis of 1992 projected intersection operations and incorporated forecasts of future traffic volumes on LMA streets. These forecasts included both anticipated development projects and assumptions of background growth in area travel. Although it is not possible to clearly determine how background growth has changed, the fact that traffic has declined on certain LMA arterial roadways would suggest that the background growth in traffic did not occur to the levels projected.

The 1987 study predicted that of the seven intersections studied, during the morning peak hour in 1992, five would operate at LOS F. The 1991 analysis shows that only three of these operate at LOS F. The 1987 study predicted that during the evening peak hour in 1992, one of the seven intersections would operate at LOS E and three would operate at LOS F. The 1991 analysis showed that two intersections are operating at LOS E and two are operating at LOS F.

Table 5 COMPARISON OF 1987 AND 1991 INTERSECTION LEVEL OF SERVICE

Intersection	Year	Entering Vehicles	V/C*	Delay**	LOS***	Comments
Morning Peak Hour						
Longwood Avenue/	1987	2,940	0.75	40	D	Cycle length shortened and
Riverway	1991	3,443	1.10	60+	F	green time was reallocated
Longwood Avenue/	1987	2,490	0.93	27	D	Restriping and meter removal
Brookline Avenue	1991	2,533	0.74	19	C	have increased capacity
Longwood Avenue/	1987	2,370	0.89	28	D	Phasing was changed with
Huntington Avenue	1991	2,949	1.02	60+	F	removal of southbound lead
Brookline Avenue/	1987	4,065	0.79	19	C	Green time by approach
Park Drive	1991	3,636	0.72	37	D	has been reallocated
Brookline Avenue/	1987	3,745	0.71	32	D	
Fenway	1991	3,415	0.64	14	B	
Brookline Avenue/	1987	3,930	1.07	60+	F	
Riverway	1991	3,605	1.07	60+	F	
Huntington Avenue/	1987	2,190	0.76	24	C	Cycle length has increased by
Francis Street	1991	2,198	0.68	23	C	20 seconds
Evening Peak Hour						
Longwood Avenue/	1987	3,020	0.97	43	E	See AM Peak Hour
Riverway	1991	3,334	0.91	45	E	
Longwood Avenue/	1987	2,660	0.85	50	E	See AM Peak Hour
Brookline Avenue	1991	2,578	0.74	33	D	
Longwood Avenue/	1987	2,510	0.98	32	D	Some improvement possible
Huntington Avenue	1991	3,184	0.97	60+	F	with signal retiming
Brookline Avenue/	1987	4,445	0.89	26	D	See AM Peak Hour
Park Drive	1991	4,119	0.81	22	C	
Brookline Avenue/	1987	3,440	0.68	18	C	
Fenway	1991	3,290	0.63	12	B	
Brookline Avenue/	1987	4,170	1.08	60+	F	
Riverway	1991	3,496	0.96	60+	F	
Huntington Avenue/	1987	2,430	0.94	58	E	Peaking characteristics have
Francis Street	1991	2,569	0.86	43	E	changed

Source: Vanasse Hangen Brustlin, Inc.
* Volume-to-capacity ratio.
** Average stopped delay per vehicle in seconds.
*** Level of service.

The availability of adequate parking for patients, visitors, and certain groups of employees within the LMA is integral to its continued viability as an economic sector of the Boston economy. In response to concerns of "over-building" the LMA parking supply, MASCO investigated the history of parking construction and building development over the past thirty years. An analysis of the relationship between parking supply and development indicates that parking for the LMA community has grown at a relatively constant rate over the past thirty years.

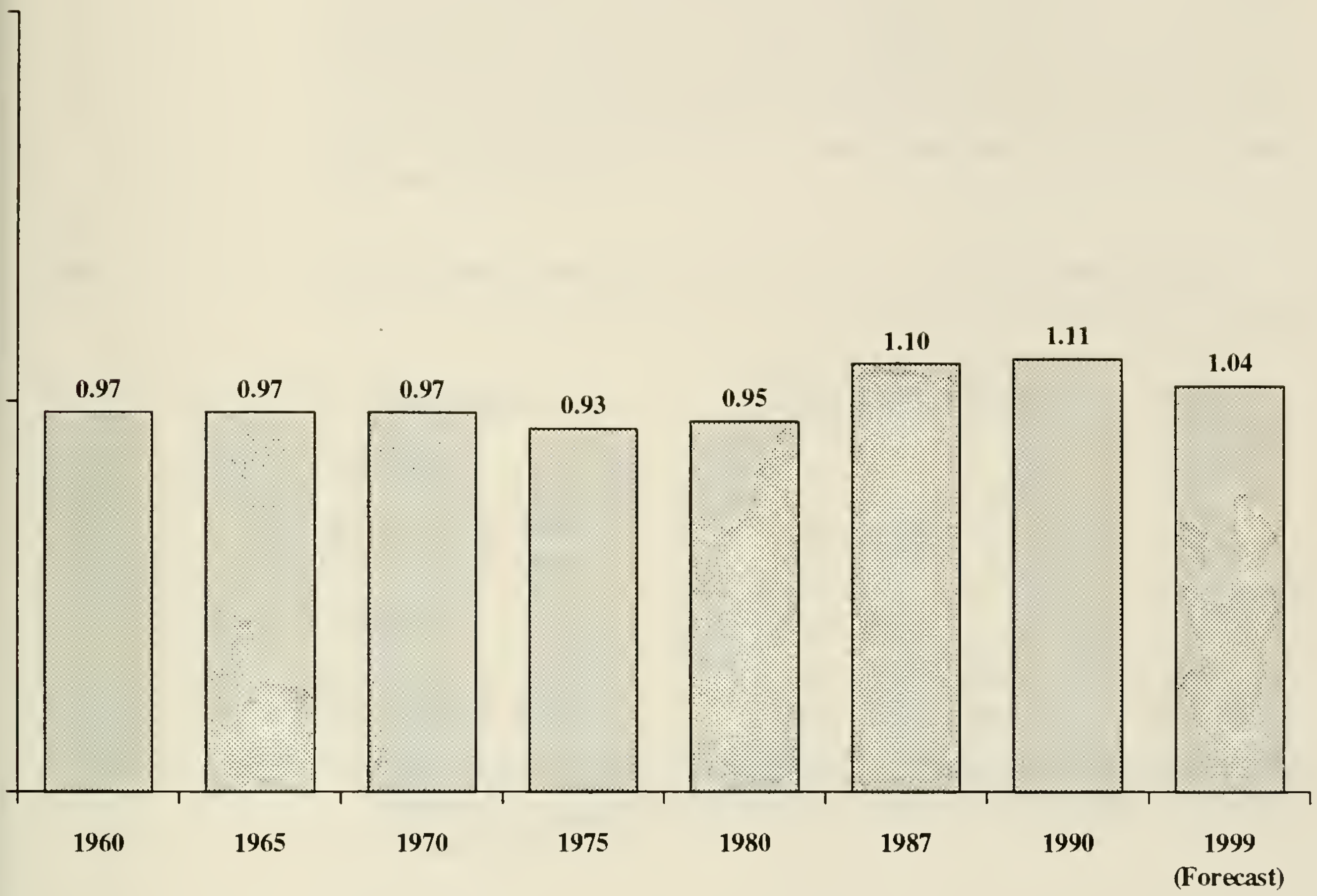
Relationship Between Parking and Land Use

MASCO has compiled a data base on parking supply and total building area within and serving several of the LMA institutions between 1960 and 1990. The historical and projected 1999 relationship between parking and land use for the area's medical institutions plus the Harvard schools is plotted over a time line in Figure 4. Note that these figures do not include the other schools or non-member institutions. This relationship is presented as a ratio of parking supply per thousand square feet (SF) of building area. As shown in the figure, the ratio of parking supply to building area for these medical institutions has remained relatively constant over the past 30 years, ranging between 0.93 spaces per thousand SF to 1.11 spaces per thousand SF. It must be pointed out that the figures represent a "blended ratio" that includes the Harvard schools and the medical institutions. The actual ratio of parking spaces to square footage would be slightly higher if the medical institutions were considered alone.

In a separate study of the other educational institutions in the LMA, it was shown that the 1990 ratio of parking spaces per thousand SF is 0.65. For the year 1999, the overall ratio for both medical and all MASCO member educational institutions is forecast to be 1.03 spaces per thousand SF, continuing to remain consistent with past trends.

The fact that this ratio has not increased substantially is significant. Since 1960, the level of automobile ownership has dramatically increased, as have traffic volumes within the Boston region. Since the late-1970s the amount of building area devoted to outpatient activities within the LMA has also increased significantly. Data from three of the four LMA hospitals (Beth Israel, Brigham and Women's and Children's) show that the number of outpatient visits increased 57 percent between 1980 and 1990 while inpatient activity increased 35 percent during the same decade. Outpatient activities result in the need for far more parking spaces than other uses such as inpatient activities. With more employees and patients having access to vehicles, and with more patients traveling to the LMA in general, parking demands are likely to have greatly increased, while parking supply has grown only at a rate commensurate with building development.

The discussion within this report has focused primarily on the supply of parking. Because there is substantial interest in better understanding how the LMA's parking system functions now and in the future, MASCO will soon be undertaking a comprehensive evaluation of the demand for parking as it relates to the supply in the LMA, including an evaluation of parking management and future parking needs.



umber of parking spaces and building area is for medical institutions and
rvard Schools only, and does not include other LMA educational institutions, except for forecast year.

Vanasse Hangen Brustlin, Inc.

LMA Medical Institution Parking
and Total Building Area-
Parking Spaces per thousand SF
of Building Area 1960-1999*

Figure 4

TRIP GENERATION FORECASTS

As described earlier in this report, a five-year development forecast was prepared for the 1987 LMA study. This forecast was then revised in 1991 to reflect the latest available information. Using this information, a revised forecast of vehicle trip generation related to future development is presented in Table 6. As shown in the table, a total of 63 new morning peak hour vehicle trips and 65 new evening peak hour vehicle trips are projected to occur by 1992 in addition to the trips forecast for 1992 as prepared for the 1987 transportation study. Between 1993 and 1999, a total of 1,460 new morning peak hour and 1,504 new evening peak hour vehicle trips are forecast. When comparing the evening peak hour trip generation with the forecast development of two million square feet, the resulting peak hour trip generation rate is 0.7 vehicle trips per thousand square feet.

Table 6

FUTURE PEAK HOUR NET NEW VEHICLE-TRIP GENERATION

Time Period	Entering Trips	Exiting Trips	Total Trips
1987-1992*			
Morning Peak Hour	43	20	63
Evening Peak Hour	16	49	65
1993-1999			
Morning Peak Hour	1,015	445	1,460
Evening Peak Hour	461	1,043	1,504

* Trips shown for this period result from revised development forecasts and are in addition to trips forecast to occur between 1987 and 1992 in the 1987 LMA Transportation Study.

It should be noted that the above forecasts do not include the new peak hour trips associated with the Olmsted Plaza development, located on the northern edge of the LMA. This development has been substantially downsized as a result of current economic conditions. The reduction in its size and composition of the uses therein is estimated to result in a net decrease of 370 vehicle trips in the morning peak hour and 496 vehicle trips in the evening peak hour.

Although the level of additional 1999 peak hour traffic appears high, given the amount of development under consideration, the trip generation rate is relatively low. The calculations are also based upon the assumption that travel patterns will remain similar to late-1980s conditions. MASCO, through its CommuteWorks service, is working to lower vehicle trip generation in and around the LMA. Several mitigation measures aimed at better managing transportation demand are described in the next section.

This section of the report focuses on the numerous mitigation measures that have been evaluated and proposed to address traffic congestion and other transportation deficiencies within the LMA. Presented in the following paragraphs is an assessment of the improvements recommended in the 1987 study, a status report on those strategies being pursued, and a set of additional recommendations.

1987 LMA Study Recommendations

After considering 54 alternative options for improving the overall level of transportation service in the LMA, including roadway improvements, traffic reduction measures, transit improvements, and pedestrian access improvements, the 1987 study focused on options which could be implemented within the five-year time frame in order to meet the forecast transportation demand. The recommended plan consisted of 35 of the 54 analyzed improvement strategies, including four of the eight construction strategies, nine of the ten other roadway improvement strategies, three of the nine circulation changes, seven of the 11 traffic reduction strategies, seven of the nine management strategies, four of the five pedestrian access improvements, and the one site design strategy. Six strategies were suggested for the long term (two to five years), while 28 were proposed for the short term (less than two years). The remainder were either not recommended or it was suggested that they receive further study.

The recommended improvements were designed to be both technically and institutionally feasible, implementable over the short term, and without major construction, disruption, or requiring eminent domain land takings. All strategies with significant adverse effects on adjacent neighborhoods were rejected, and increased enforcement of resident permit parking was part of the recommended plan. As a result, the net impact on adjacent neighborhoods was intended to be positive due to improvements to the roadway, transit and pedestrian systems used by both area residents and LMA commuters.

The recommended plan balanced the interests of the LMA's neighbors with the interests of the MASCO member institutions' employees and students, of whom 38 percent are Boston residents. Unlike earlier plans, the 1987 plan did not involve taking private property or public parkland along Francis Street, Longwood Avenue, Huntington Avenue and The Riverway, but instead was developed to make the existing transportation system work better. The plan presented the institutions and its neighbors with a "win-win" situation, in which the cooperation of all parties could bring about mutually beneficial solutions.[6]

Status of Mitigation Measures

A number of the recommendations from the 1987 study have been implemented over the past few years while several have required further study or were suggested for longer-term consideration.

6/ Longwood Medical Area Transportation Study, Technical Memorandum #3, Recommended Improvements, Vanasse Hangen Brustlin, Inc., May 1988

One of the key mitigation measures that has been successfully implemented is the establishment of CommuteWorks, the Transportation Management Organization for MASCO members. CommuteWorks is a MASCO program operated by the Area Planning and Development department and its services include:

- Personalized assistance in choosing the most efficient and cost-effective means of transportation
- Mass transit schedules and route information
- RideSource, a computerized ride matching system
- Information on commuter cost savings such as T-pass sales, discounts, and subsidies, Massachusetts Turnpike Authority carpool passes, carpool lanes, and free preferential parking for vanpools[7]

Each member institution has assigned an Employee Transportation Advisor who is made available to its staff members to provide personal assistance in locating commuting information. In its first-year report, CommuteWorks successfully implemented several demand management strategies including:

- Completion of an employee commuter mobility survey at twelve member institutions
- Completion of draft commuter mobility workplans for twelve member institutions
- Formalization of commuter mobility programs for four member institutions
- Developed promotional brochures
- Administered RideSource, a computerized ride-matching service
- Conducted a transportation day event and participated in the World Class Commuting Day event

Other mitigation measures implemented by MASCO include:

- Worked with the Boston Transportation Department (BTD) and the Massachusetts Bay Transportation Authority to improve transit access to the LMA such as route changes and to improve flow on LMA streets through traffic signal improvements[8]
- Negotiated an agreement with the BTD for a series of additional signalization improvements along Longwood Avenue to be implemented during 1992

Table 7 provides more detail on the status of each action proposed in the 1987 study.

7/ "CommuteWorks, the Longwood Medical Area Transportation Management Organization," informational brochure prepared by MASCO, April 1990

8/ The CommuteWorks Program, First Year Evaluation, CommuteWorks, February 1991

Table 7 STATUS OF 1987 LMA TRANSPORTATION STUDY RECOMMENDATIONS

Number	Description	Status
Roadway Construction Strategies		
A1	Modify Intersection of Fenway and Avenue Louis Pasteur	Will be beneficial to Ave. Louis Pasteur developments including reuse of English High School, Blackfan St. extension
A2	Connect Parking Facilities to Avenue Louis Pasteur	Part of long-range planning for LMA.
A3	Widen Longwood Ave. Between Binney St. and Brookline Ave.	Expected to occur as part of the Clinical Center development at Beth Israel Hospital
A8	Modify the Sears Rotary: Close its Eastern Loop and Signalize The Riverway Merge	Olmsted Plaza mitigation funding for improvements is now uncertain. These strategies should still be actively pursued, however.
Other Roadway Improvements		
B1-B8	Reallocate Available Roadway Width and Green Signal Time	Meters have been removed on Longwood and Brookline Avenues. Future meter removals should be considered. Current signal timing and phasing should be re-evaluated by MASCO with the BTD and MDC.
B9	Upgrade the Longwood Avenue/Riverway Signal; Extend to Chapel Street	Proposed to BTD as part of MASCO FY92 traffic improvement program
Circulation Changes		
C1	Riverway/Brookline Avenue One-Way Pair	Can continue to be deferred for longer-term consideration due to reduced volumes in LMA.
C2	Northbound Left-Turn Restriction at Huntington/Longwood Aves.	Proposed to BTD as part of MASCO FY92 traffic improvement program
C8	Make Pilgrim Road Two-Way From Joslin Pl. to Deaconess Garage	Will be included in New England Deaconess Hospital plans.
Traffic Reduction Strategies		
D1	Raise Parking Fees for Employees	See E1 below
D2	Provide and Market Transit Subsidies for Employees	Most institutions sell and subsidize T passes. CommuteWorks markets availability of transit subsidies to employees. Additional strategies are being discussed.
D4	Ridesharing Program	CommuteWorks provides the RideSource computerized matching service. Over 250 commuters participated in the first year. This should be continued.
D5	"Alternatives to Driving Alone to the LMA" Campaign	CommuteWorks holds transportation days twice per year. These are promotional events to stimulate interest in transportation options.
D6	Improve MBTA Service on the Riverside and Arborway Lines	MBTA has increased number of cars per train and Arborway Line has been extended to Heath Street

Table 7 STATUS OF 1987 LMA TRANSPORTATION STUDY RECOMMENDATIONS (Cont'd.)

Number	Description	Status
Traffic Reduction Strategies (Continued)		
D7	Improve MBTA Service to Ruggles Station and Roxbury-Dorchester (Extend MBTA Bus Route 19 into the LMA)	MBTA has extended Route 8 to Kenmore via LMA improving service to Ruggles. Service to Roxbury has not been improved.
D11	Coordinate a Voluntary Staggered Work Hours Program	Most institutions have an informal program. CommuteWorks is working to expand staggered work hours wherever possible.
Management Strategies		
E1	Parking Management	MASCO is undertaking a long-range areawide parking study to help determine overall parking conditions and future needs.
E2	Improve Enforcement of Traffic and Parking Regulations	This requires a consistent level of effort by the BTD.
E3	Construction Management	Controlled by BTD's Construction Management Agreements for each development project and coordinated closely by MASCO and with city support.
E4	Restrain Street Closures	Policy has been adopted by MASCO members and has City support
E5	Limit On-Street Loading	To be studied by MASCO staff in the future
E6	Detail Traffic Control Officers at LMA Intersections	This action should be placed on hold for future consideration.
E9	Assessments for LMA Transportation Improvements	Each institution has remained responsible for making its own roadway improvements necessitated by development projects.
Pedestrian Access Improvements		
F1	Install Stop Sign at Avenue Louis Pasteur and Longwood Avenue	Completed
F2	Provide Security to MBTA Users	Some institutions (Children's, Harvard, Beth Israel) are providing shuttles or taxi vouchers to take employees to MBTA stations
F3	Improve Streetscape Amenities	Being addressed through MASCO open space program and by members through development projects.
F4	Improve Connection to Longwood Station	Short Street signal proposal is on hold as a result of concerns raised by abutters
Site Design Considerations		
G1	Keep Garage Queues and Drop-Off Driveway Queues Off Streets	Incorporated in all recent projects.

Recommended Mitigation Strategies

As documented elsewhere in this report, the transportation and development environment in the LMA has changed from what had been forecast in the 1987 study. Based upon a review of these changes and current conditions within the LMA, a series of recommendations for future mitigations strategies have been developed. These include the following types of recommendations:

- Strategies recommended in the 1987 study that are still needed and should be implemented or pursued
- Strategies that require additional evaluation
- Strategies that should be deferred for future consideration, and
- New, additional strategies with some suggested for immediate implementation

The following paragraphs, organized according to the categories developed for recommendations in the 1987 study, represent an updated set of recommended mitigation strategies. The numbers in parentheses refer to the earlier study.

Roadway Construction Strategies

Modify Intersection of Fenway and Avenue Louis Pasteur (A1); Connect Parking Facilities to Avenue Louis Pasteur (A2). The implementation of these improvement strategies in conjunction with development projects located near this road over the next three to five years will provide a substantial traffic circulation benefit and continue to be recommended. These improvements will require diligence and a sensitivity to community issues as more traffic could result on Park Drive.

Modify Sears Rotary (A8). It is also recommended that the improvements to the Sears Rotary identified previously be pursued on a continuing basis despite the potential for loss of private mitigation funding from the Olmsted Plaza development.

Other Roadway Improvements

Evaluate Traffic Signal Operations in LMA. It is recommended that MASCO undertake a comprehensive evaluation of signal operations in conjunction with the Boston Transportation Department and the Metropolitan District Commission to ensure that each signal in the LMA is operating as efficiently as possible and that all coordination and signal optimization opportunities are implemented. Should hardware-related limitations arise, then strategies for upgrading traffic signals should be pursued.

Remove Parking Meters on Brookline Avenue (B1-B3). Although the majority of previously recommended parking meter removals have been implemented, there are specific locations where additional meter removals will be beneficial, including:

- Brookline Avenue in front of Beth Israel Hospital to extend the five-lane section further north, allowing a separate left-turn lane for traffic entering the hospital
- In front of Dana-Farber Cancer Institute (DFCI) on Brookline Avenue to discourage illegal parking on Brookline Avenue between the spaces in front of DFCI and Longwood Avenue, and
- The Brookline Avenue northbound approach to the Brookline Avenue/Riverway intersection to permit right-turning motorists to pass through the intersection more freely

Improve Traffic Signals on Longwood Avenue. MASCO has undertaken a project to improve signal operations on Longwood Avenue at three intersections: Chapel Street, The Riverway, and Huntington Avenue. The project, which will be designed in 1992, consists of:

- Replacement of the existing traffic signal controller, crosswalk revisions, and definition of a modified pedestrian crossing program to allow an exclusive pedestrian crossing interval during a non-conflicting vehicle movement phase at the intersections of The Riverway and Longwood Avenue
- A signal equipment upgrade for the intersection of Longwood Avenue and Chapel Street in Brookline including the development of a time-based coordination program between this intersection and The Riverway/Longwood Avenue intersection.
- Signing and pavement marking plans to prohibit left turns from Huntington Avenue eastbound to Longwood Avenue and provide for an exclusive right-turn lane on Huntington Avenue westbound. Restricted left turns would be directed to Tetlow Street instead.

Circulation Changes

Riverway-Brookline Avenue One-Way Pair (C1). The proposal to create a one-way pair of Brookline Avenue and The Riverway should be deferred for long-term future consideration. The need for this strategy, which was not endorsed by MASCO's members in the 1987 study, is not as apparent now as was previously determined. It may still be more appropriate as a long-term solution to traffic circulation deficiencies a The Riverway/Brookline Avenue intersection and along Brookline Avenue.

No other new circulation changes are recommended.

Traffic Reduction Strategies

The recently initiated LMA Parking Study will provide an extensive data base of information with respect to parking management issues. An evaluation of the parking fee structure will be completed as part of this study.

T-Pass Subsidy Programs. MASCO and its members should continue to subsidize transit passes as they do now, generally at the level of a 25 percent subsidy. The focus of ongoing efforts should be to find ways to encourage transit use by those who do not need to drive on a daily basis. One measure could offer a subsidy to non-monthly transit riders (those who drive some of the time and can ride transit the rest of the time).. Those employees would not be required to surrender parking privileges but would be encouraged to reduce the number of days they drive to the LMA.

Promote Ridesharing. The efforts to encourage ridesharing and other alternatives to driving alone to the LMA, currently coordinated by CommuteWorks, should be strongly endorsed and promoted at each institution. This promotion could take the form of institutional publications which market alternatives, having institution-sponsored transportation alternatives days, and other strategies to encourage additional participation.

One measure that should be expanded is the "emergency ride home" program, an additional incentive for employees to carpool or vanpool. This program provides assurances to an employee who may need to return home early as a result of an emergency such as an illness or family responsibilities. The employee can participate in a carpool and vanpool and can know that he or she can take a taxi home at no cost, if needed. This program has already been implemented by two institutions. As financial constraints ease, additional institutions should consider this program's adoption.

Staggered Work Hours. MASCO should continue to promote staggered work hours as a traffic reduction strategy with the understanding that this measure has limited benefits due to the nature of the medical area. For example, employees such as nurses have to be at work at a specified time to relieve another nurse from the previous shift. This strategy should be promoted to those groups of employees who do not have to be at work to relieve another worker (e.g., administrative and clerical personnel).

For many employees, using public transportation is not a valid alternative to driving for a variety of reasons. These include work schedules which include early morning or late night hours when public transportation services are not as convenient. Other reasons include the need to be at work on-time, commuting time, access to transit, pedestrian connections between transit stations and place of employment, and service quality. For those who need to drive, sensitivity to parking prices appears to be less of an issue. It should be noted however, that limiting the amount of employee parking, an ongoing practice for most member institutions, has the potential for limiting the ability for institutions to recruit employees.

Improvements to MASCO and other Shuttle Services. MASCO should also consider upgrading its bus vehicle fleet for those who are transit riders to higher-quality vehicles. The full-size bus remains the best vehicle to use for transit and many parking shuttle routes and MASCO should consider purchasing or leasing more modern vehicles with more comfortable seats and

other amenities. Although some institutions have recently acquired their own shuttle buses to serve employee parking lots, it is suggested that these smaller vehicles be considered for consolidation into a LMA-wide fleet. This consolidation would not eliminate that direct service between institutions and parking areas but could allow for the efficient use of these vehicles while possibly reducing bus traffic in the LMA.

In addition, it also recommended that bus connections between the LMA and remote facilities and major MBTA facilities such as Back Bay Station be improved through public or private routes. Currently institutions along Huntington Avenue are served by an MBTA bus that travels to/from Back Bay Station while institutions on the Brookline Avenue side of the LMA have no direct connection available.

Advocate for Public Transit Service Improvements. Regardless of the need for many employees to drive, improving public transportation services to and within the LMA should be a primary focus of MASCO and its members. MASCO has recently been conducting focus groups for employees to find out why people commute by automobile, rideshare, or use transit. When transit riders are interviewed, their input on how to improve transit service should be sought. Any improvements that are thought to be feasible should be presented to the MBTA. MASCO should continue to press for service improvements, including the Arborway Line, and should actively lobby for implementation of a circumferential transit line through the LMA. By sharing information on the trip origins of LMA employees, by suggesting improvement to circumferential bus routes, and by advocating the concept to its members and the transportation agencies in the area, continued attention can be paid to this needed long-range solution.

MASCO should continue to pursue improved access to Ruggles Station via commuter rail as well as station improvements that will encourage ridership. These improvements include better waiting areas, lighting, security and train announcements for incoming trains. A long-term transit strategy is also recommended to project potential future ridership and plans for additional service improvements.

MASCO should continue to evaluate suburban shuttle bus routes to remote parking locations. As more parking is needed to serve future development, MASCO should continue to consider participating in the development of parking on air rights above the Massachusetts Turnpike. This would be in keeping with the concept of developing off-site parking in easily accessible locations.

Management Strategies

Enforce Traffic and Parking Regulations (E2). This strategy has been the subject of numerous discussions between MASCO and the Boston Transportation Department. Although parking enforcement levels had been increased, more enforcement appears to be needed. The parking enforcement issue will be discussed further as part of the ongoing parking study. One area that warrants more attention, however, is the need for towing illegally parked vehicles, especially near bus stops, and on Brookline and Longwood Avenues. This strategy should be aggressively pursued. With respect to the use of traffic control officers to supplement the traffic signals now in place, this strategy does not appear warranted at this time and should be deferred.

The measures MASCO has successfully been undertaking in construction coordination, limiting street closures, encouraging all loading in new projects to take place off-street, should all be continued.

__Assessments for LMA Transportation Improvements (E9)__. Although the 1987 study had recommended the concept of impact fees to fund transportation improvements, it appears that transportation improvements have proceeded through a combination of MASCO-funded areawide improvements and the individual development projects of MASCO members. Each institution should continue to coordinate its mitigation and improvement activities closely with MASCO to ensure consistency and communication.

Pedestrian Access Improvements

Because rail transit services are provided on the eastern and western edges of the LMA and not through the center, the quality and security of pedestrian connections between stations and workplaces are critical. Continued improvements in this regard, such as improved bus service to transit stations and security improvements should be aggressively pursued. In addition, although not fully supported in the past by MASCO members, the proposal to construct a pedestrian signal on The Riverway at Short Street should be pursued further. This signal would permit pedestrians traveling to and from the Longwood MBTA station to cross at this location and thus reduce their travel time to and from the LMA.

Site Design Considerations

No new recommendations are offered at this time.

TRANSPORTATION MANAGEMENT GOALS

MASCO remains committed to expanding efforts to reduce the number of employees who drive alone to work in the LMA. In this regard, similar to commitments being made by its members who have executed transportation access plan agreements with the Boston Transportation Department, MASCO and its members will establish a goal of reducing the percentage of employees who drive to work from approximately 57 percent to 52 percent within the next five years. This change of five percent is consistent with access goals established by member institutions and is rather aggressive. Transportation patterns must change significantly in order for this goal to be realized. Although difficult to quantify, through the promotion of ridesharing it is also desirable to work to increase the average number of persons per vehicle for employees commuting to the LMA.

To monitor the progress towards achieving this goal, it is recommended that MASCO establish an areawide employee survey plan. This survey should be given to a randomly selected sample of employees on an annual basis. An annual survey of area employees will be more efficient to administer than periodic "100 percent" samples of each institution's employees and will provide the statistical controls necessary to track progress toward achieving the aforementioned five percent reduction.

Many other policies related to parking management and parking supply will be carefully evaluated as part of the LMA parking study and they will be reviewed over the next year.

CONCLUSION

In conclusion, although traffic conditions have improved at some locations within the LMA, other improvements are still needed. The strategies reiterated in this report as well as the new recommendations outlined herein are intended to improve, primarily in the short-term, the overall transportation system within the LMA. It is important that each of the strategies presented continue to be promoted and implemented with close cooperation between MASCO and public agencies such as the BRA, BTD and MDC. At the same time, impediments to making some of the more complicated improvements need to be fully examined and resolved with these agencies. Long-range planning in the areas of new circumferential transit and other potential public transportation service improvements needs to be reemphasized. Simultaneously, MASCO, with its members, must develop a long-range demand-management strategy building upon the existing CommuteWorks program and upon the recommendations which come from the long-range parking study.

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